

## **JULY 2012 FLOODING - THE BALOG SUBMISSION**

The monthly rainfall records have been checked at nearby stations. Starting with the longest records these are as follows:

- Geelong Salines (Moolap) has the longest record 1897-2013 (monthly records not available after 2011).
- Next longest is Geelong Golf Club (1925-2004).
- Grovedale (Geelong Airport) is the closest but only has records 1983-2011.
- Of the currently operating stations, Ocean Grove opened in late 1996, Barwon Heads Golf Club opened in 2001, Clifton Springs opened in 2004, and Breakwater (Geelong Racecourse) opened in 2011.

The period of flooding referred to by Mr Balog is the event of July 2012. As flooding in the area is usually associated with longer duration rainfall events and wet catchments it is informative to look at the May/June/July period records:

- The long term records at Geelong Salines (Moolap) show mean monthly average rainfall in this period is 48/45/47 mm respectively.
- The long term records at Geelong Golf Club show close agreement with 49/46/46 mm respectively.
- The maximum monthly rainfalls at both stations are 100/104/118 mm respectively and 101/100/115 mm respectively.

**The long term records are therefore consistent for the area.**

At the closest station (Grovedale) which has just 18 years of record the means of 47/42/49 mm for May, June and July respectively match up well with the long term records.

**Looking now at what actually happened in May/June/July 2012 at the closest stations:**

- Monthly totals 107/102/69 mm respectively (total 278 mm) at Barwon Heads GC.
- Monthly totals 105/103/81 mm respectively (total 289 mm) at Ocean Grove.
- Monthly totals 90/112/69 mm respectively (total 271 mm) at Clifton Springs.
- Monthly totals 83/104/56 mm respectively (total 243 mm) at Breakwater.

**The recorded data indicates May and June 2012 rainfall in Armstrong Creek catchment was likely to have been equal to or greater than the maximum recorded for each of those months over the long term.**

**The 3 monthly total for May/June/July 2012 was double the sum of the long term means for each month.**

**The rainfall records clearly show that very significant flooding would have occurred in the Armstrong Creek area regardless of any development in this period in 2012.**

**Could Urban Development have significantly influenced the flood of July 2012?**

Aerial photos are available via Google Earth at intervals since 2002 and from nearmap.com at regular intervals since 2009. An extract of the nearmap photo taken in October 2012 is attached together with relevant conclusions.

**Given the limited extent of urban development that had occurred in July 2012, and the magnitude of the rainfalls, it is concluded that Warralily could not have played a significant role in this flood. As Groves Rd is physically separated from Armstrong Creek, the reported flooding is also not affected by Warralily.**



***Nearmap.com 29 October 2012.***

Total catchment of Armstrong Creek at Barwon Heads Road is 2,480 ha. Total development area disturbed in Warralily <100 ha (4%). Area of streets and houses completed <20 ha (0.8%). **Development in HBP area zero.**

**Conclusion 1:** given the small size of development and the magnitude of the rainfalls, the July 2012 flood in Armstrong Creek could not have been significantly affected by Warralily.

**Conclusion 2:** as there was no development in the Sparrovale catchment (then or now) and those wetlands are not connected to Armstrong Creek, the magnitude of the July 2012 flood in Groves Rd/Sparrovale could not have been affected by (a) Warralily, or (b) urban development at all.

## Monthly Rainfall (millimetres)

### GEELONG SALINES (MOOLAP)

Station Number: 087023 · State: VIC · Opened: 1897 · Status: Closed 29 Apr 2013 · Latitude: 38.16°S · Longitude: 144.40°E · Elevation: 4 m

#### Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<b>Mean</b>	32.0	35.8	38.3	42.2	47.8	44.9	47.2	50.3	49.9	53.7	47.0	42.5	538.5
<b>Lowest</b>	0.5	1.4	2.5	0.0	2.5	9.0	8.8	8.8	9.9	4.1	3.6	0.0	281.6
<b>5th percentile</b>	2.4	2.6	5.4	5.9	11.1	15.9	20.3	15.2	18.3	12.5	10.1	8.4	342.3
<b>10th percentile</b>	5.0	4.7	8.3	9.9	15.7	20.9	25.2	20.6	24.0	17.8	15.5	11.6	386.3
<b>Median</b>	29.0	23.0	27.4	36.1	47.3	41.3	43.2	49.2	46.7	49.3	38.1	37.1	539.2
<b>90th percentile</b>	65.7	91.6	92.0	82.9	78.8	73.6	76.0	81.0	78.4	90.0	89.3	83.2	683.3
<b>95th percentile</b>	78.5	107.3	95.9	99.1	87.4	85.6	84.4	90.2	86.6	100.2	108.6	91.4	748.6
<b>Highest</b>	131.8	192.6	172.9	144.1	100.0	104.3	118.3	142.7	141.6	147.2	152.6	128.3	907.7

## Monthly Rainfall (millimetres)

### GEELONG GOLF CLUB

Station Number: 087024 · State: VIC · Opened: 1925 · Status: Closed 28 Jul 2004 · Latitude: 38.13°S · Longitude: 144.34°E · Elevation: 15 m

#### Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<b>Mean</b>	35.5	41.8	37.7	43.9	48.7	46.3	45.8	50.9	53.6	56.5	48.4	46.3	562.7
<b>Lowest</b>	0.0	0.0	1.8	6.1	8.9	12.9	11.0	7.8	14.9	4.5	3.8	2.6	269.7
<b>5th percentile</b>	2.3	1.3	3.8	9.9	12.6	17.1	13.9	21.1	18.5	17.4	12.5	6.3	401.6
<b>10th percentile</b>	4.5	2.6	7.2	11.6	16.4	20.8	19.5	25.8	29.9	22.2	19.0	11.5	444.7
<b>Median</b>	28.9	30.0	27.4	41.7	48.6	45.5	45.3	48.8	50.5	54.1	41.0	40.6	549.3
<b>90th percentile</b>	77.1	95.8	64.7	87.8	80.7	74.2	75.4	75.2	79.9	91.2	90.1	89.3	716.8
<b>95th percentile</b>	86.7	112.3	89.8	98.9	91.6	84.5	87.3	80.7	86.3	101.0	123.1	100.4	773.8
<b>Highest</b>	133.3	210.3	240.4	118.1	100.5	99.8	114.7	157.7	116.2	140.0	145.6	114.7	882.8

## Monthly Rainfall (millimetres)

### BARWON HEADS GOLF CLUB

Station Number: 087135 · State: VIC · Opened: 2001 · Status: Open · Latitude: 38.28°S · Longitude: 144.48°E · Elevation: 8 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001													37.5
2002	27.4	93.4	18.8	25.6	48.8	28.5	23.1	37.7	30.8	25.5	15.2	24.6	399.4
2003	26.6	21.0	29.0	50.8	19.4	19.4	82.0	70.4	35.2	94.1	34.6	26.4	508.9
2004	41.0	27.8	25.4	52.0	50.4	63.6	53.2	65.8	72.6	39.2	84.2	20.4	595.6
2005	55.6	135.0	8.4	13.0	13.0	50.8	58.8	68.0	58.8	44.0	37.0	27.7	570.1
2006	28.6	22.7	8.2	50.8	44.8	25.0	24.6	21.6	28.0	8.4	16.0	23.8	302.5
2007	53.4	21.2	18.6	29.0	37.0	77.0	121.2	40.6	27.6	26.4	114.8	60.4	627.2
2008	10.3	30.6	17.7	14.0	34.8	53.0	73.0	60.0	30.8	10.4	39.4	66.7	440.7
2009	2.4	5.2	29.2	54.8	13.4	35.4	80.0	62.0	81.4	56.8	99.4	32.4	552.4
2010	33.8	28.6	58.2	25.0	39.4	78.4	39.4	97.0	73.2	116.4	95.2	54.0	738.6
2011	101.6	82.0	45.2	42.4	55.2	43.0	65.4	23.2	48.6	78.2	92.8	21.2	698.8
2012	20.6	58.6	34.4	64.4	106.6	102.2	69.2	69.4	34.6	38.8	35.2	25.0	659.0
2013	7.8	32.2	31.2	16.6	54.2	95.4	50.1	64.2	57.1	74.2	55.7	42.6	581.3
2014	14.1	13.6	30.6	55.2	36.2								

## Monthly Rainfall (millimetres)

### GROVEDALE (GEELONG AIRPORT)

Station Number: 087163 · State: VIC · Opened: 1983 · Status: Closed 08 Aug 2011 · Latitude: 38.22°S · Longitude: 144.33°E · Elevation: 33 m

#### Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<b>Mean</b>	37.3	31.5	32.0	45.2	46.5	42.2	49.2	49.1	49.7	51.3	52.8	40.1	524.3
<b>Lowest</b>	0.4	2.2	1.6	4.0	9.8	5.8	11.0	24.2	27.4	11.2	14.8	3.4	285.4
<b>5th percentile</b>	3.3	6.5	3.5	10.2	10.5	15.4	17.3	26.4	29.9	12.0	19.0	5.4	368.2
<b>10th percentile</b>	8.1	8.3	6.5	11.0	11.8	16.5	18.4	27.2	31.4	19.8	25.2	11.7	386.8
<b>Median</b>	26.0	26.2	26.4	39.2	45.4	42.6	49.8	48.6	46.4	41.2	40.3	32.1	513.4
<b>90th percentile</b>	71.2	57.6	66.6	75.1	110.6	64.1	82.8	70.8	70.0	90.7	92.8	78.8	667.6
<b>95th percentile</b>	109.1	69.2	88.6	125.0	123.7	70.1	85.2	77.8	77.1	118.2	103.3	96.7	678.8
<b>Highest</b>	130.4	127.0	100.2	181.8	124.4	73.0	96.4	79.6	104.6	149.8	125.4	104.4	745.0





